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Site Specific Nutrient Management of *kachri* in Hot Arid Region

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Abstract—*Application of different combinations of NPK doses significantly increased yield of kachri. Application 120, 60 and 60 kg/ha of N, P_2O_5 and K_2O gave the highest kachri yield (108.87 q/ha) which was significantly at par with 80, 40 and 40 kg/ha of N, P_2O_5 and K_2O . whereas, higher dry matter (%) was observed where 80 and 40 kg/ha of NK were applied but dry matter yield (11.29 q/ha) was obtained where, 120, 60 and 60 kg/ha of N, P_2O_5 and K_2O . Maximum per cent yield response was observed where 120, 60 and 60 kg/ha of N, P_2O_5 and K_2O was applied (95.88%) followed by 80, 40 and 40 kg/ha of N, P_2O_5 and K_2O (81.63%) and 80 and 40 kg/ha of N and P_2O_5 (77.89%) as compared to control.*

1. INTRODUCTION

Site-specific nutrient management (SSNM) strategies that include site and season-specific knowledge of crop nutrient requirements and indigenous nutrient supplies are required to increase productivity, yields, and nutrient use efficiency. The SSNM provides an approach for need based feeding of crops with nutrients while recognizing the inherent spatial variability. It involves monitoring of all pathways of plant nutrient flows / supply, and calls for judicious combination of fertilizers, bio fertilizers, organic manures, crop residues and nutrient efficient genotypes to sustain agricultural productivity. It avoids indiscriminate use of fertilizers and enables the farmer to dynamically adjust the fertilizer use to fill the deficit optimally between nutrient needs of the variety and nutrient supply from natural resources, organic sources, irrigation water etc. It aims at nutrient supply at optimal rates and times to achieve high yield and efficiency of nutrient use by the crop.

To achieve nutrition and income security for the people, particularly in hot arid region of north-western parts of Rajasthan, suitable crop-plant species from vegetables are of vital importance. The native crops like *kachri* support livelihood in the hostile situations, where vegetable crop diversification is not much feasible. However, limited attention was paid for its nutrient management and other crop production aspects. *Kachri* requires hot and dry climate and a long growing season preferably with warmer days for cultivation both as rainy and summer season crop. The high temperature and dryness conditions are beneficial for crop, fruit maturity and quality and are also best for dehydration of *kachri* fruits.

The crop production in the hot arid regions are constrained by low and erratic rainfall, high evapo-transpiration and adverse soil physical and fertility conditions. Arid region soils are low in organic matter, macronutrient and micronutrient (Shyampura *et al.*,2002, Rathore, 2009, Yadav and Meena, 2009, Yadav, 2011, Chattopadhyay *et al*, 1997, Singh, 2006, Singh, 2008). The low organic matter has been attributed to high temperature, low rainfall, scanty vegetation and single grained texture of soil.

Nutrients requirement of *kachri* differ with soil, climate, cultivar and growth period. Nutrients use efficiency is low in *kachri* in the hot arid region. So, there is a need to develop site-specific nutrient management. Site-specific nutrient management implies the most efficient use and management of of nutrients to attain higher levels of *kachri* productivity along with maintaining the fertility of the soil. Research works on site-specific nutrient management for *kachri* crop is scanty. However, information on response of nutrient has not been generated so far. Therefore, a field experiments was conducted at CIAH research farm with popular *kachari* cultivars AHK119 during 2014 in the kharif season to investigate the site specific nutrient management on kachari performance.

2. MATERIALS AND METHODS

The kachari crop received differential doses of NPK through inorganic fertilizers as per schedule of treatments. The seven manurial treatments involving NPK through inorganic fertilizer *viz*., 40, 20 and 20 kg/ha of NPK, 80, 40 and 40 kg/ha of NPK , 120, 60 and 60 kg/ha of NPK, 40 and 40 kg/ha of PK, 80 and 40 kg/ha of NK, 80 and 40 kg/ha of NP and without NPK (Absolute control) were replicated 3 times in a randomized block design. Nitrogen dose was applied in three splits *i.e*. $1/3^{rd}$ at planting, $1/3^{rd}$ at 25 days after sowing and rest $1/3^{rd}$ 50 days after sowing from fertilizers . Phosphorus and potassium fertilizers were applied in furrows at the planting time as per treatment. For working out net return from *kachri*, price of *kachri* was taken as Rs. 20/kg. Percent yield response was computed as follows.

Yield Response: Yield in fertilized plot - Yield in unfertilized plot

Yield in unfertilized plot

3. RESULTS AND DISCUSSION

Application of different combinations of NPK doses significantly increased yield of *kachri* as compared to control. Application 120, 60 and 60 kg/ha of N, P_2O_5 and K_2O gave the highest *kachri* yield (108.87 q/ha) which was significantly higher than all other treatments, but at par with 80, 40 and 40 kg/ha of NPK and 80 and 40 kg/ha of NP. The increase in total yield was 7.85% higher over recommended NPK through fertilizers. Application of 100% NPK increased yield significantly by 81.63% compared to control. Whereas, this treatment gave only 2.10% more kachri yield as compared to recommended dose of fertilizers.

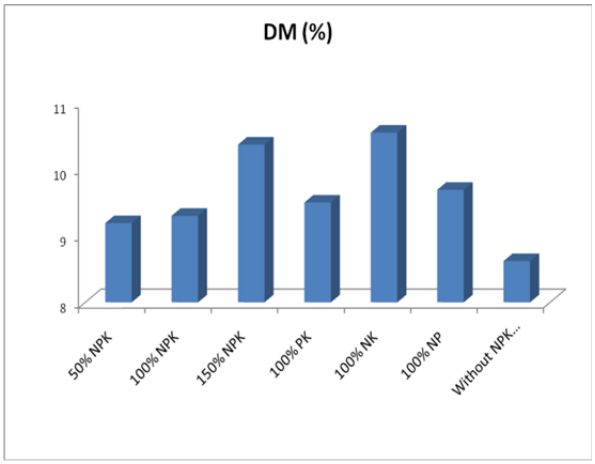
Maximum yield was obtained when 120, 60 and 60 kg/ha of N, P_2O_5 and K_2O (108.87 q/ha) followed by 80, 40 and 40 kg/ha of N, P_2O_5 and K_2O (100.95 q/ha) and 80 and 40 kg/ha of N and P_2O_5 (98.87 q/ha) and 40, 20 and 20 kg/ha of N, P_2O_5 and K_2O (82.65 q/ha). Same trend was observed for percent yield response of different treatments.

Higher dry matter (%) was observed where 80 and 40 kg/ha of NK were applied followed by 120, 60 and 60 kg/ha of N, P_2O_5 and K_2O. However, dry matter yield (11.29 q/ha) was obtained where, 120, 60 and 60 kg/ha of N, P_2O_5 and K_2O followed by 80, 40 and 40 kg/ha of N, P_2O_5 and K_2O.

Maximum per cent yield response was observed where 120, 60 and 60 kg/ha of N, P_2O_5 and K_2O was applied (95.88%) followed by 80, 40 and 40 kg/ha of N, P_2O_5 and K_2O (81.63%) and 80 and 40 kg/ha of N and P_2O_5 (77.89%) as compared to control. This might be due to more partitioning of dry matter to *kachri* as a result of balance nutrition in these treatment.

Table 1: Requirements of N, P and K fertilizers of *kachri* using omission plot technique

Treatments	Yield (q/ha)	Average of fruit (g)
40, 20 and 20 kg/ha of NPK	82.65	37
80, 40 and 40 kg/ha of NPK	100.95	40
120, 60 and 60 kg/ha of NPK	108.87	42
40 and 40 kg/ha of PK	71.25	38
80 and 40 kg/ha of NK	80.45	40
80 and 40 kg/ha of NP	98.87	33
Without NPK (Absolute control)	55.58	29
CD at 5%	13.95	9



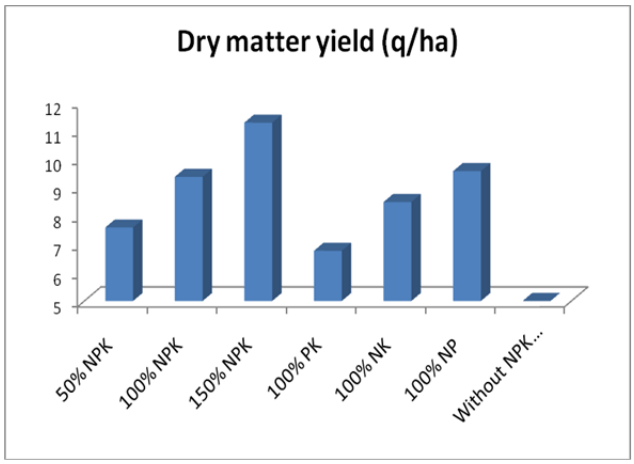


Fig. 2: Dry matter percent and yield of *kachri* using omission plot technique

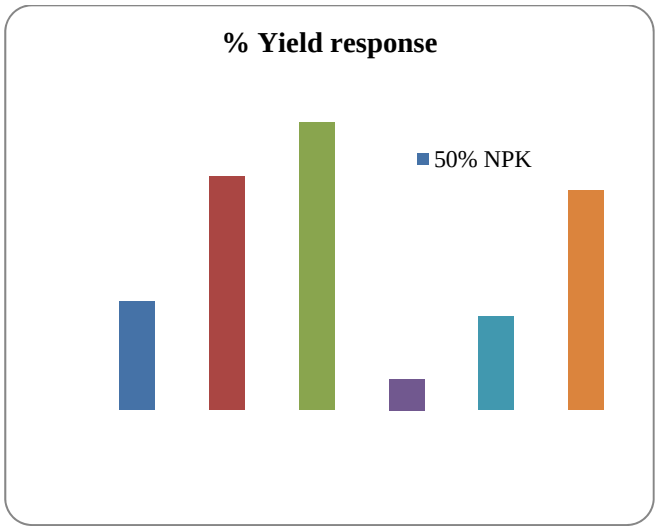


Fig 2: Percent yield response of *kachri* using omission plot technique

Net return and benefit cost ratio of the *kachri*

Net return from *kachri* followed similar trend (Table-2) as that of fruit yield with highest values of Rs 178650/ha was observed in 120, 60 and 60 kg/ha of NPK treatment. This was closely followed by 80, 40 and 40 kg/ha of NPK (Rs 164827/ha) and 80 and 40 kg/ha of NP (Rs 161947/ha). 40, 20 and 20 kg/ha of NPK application gave net return of Rs 130263/ha as compared control (Rs 83708/ha). The benefit : cost ratio was highest in the treatment receiving 120, 60 and 60 kg/ha of NPK (4.57) closely followed by 80 and 40 kg/ha of NP treatments (4.52). Whereas, control gave the lowest B:C ratio (2.54).

Table. 2: Net return and B:C ratio under treatments

Treatments	Cost of cultivation	Yield q/ha	Price /kg	Gross return	Net return	B:C ratio
40, 20 and 20 kg/ha of NPK	35037	83	20	165300	130263	3.72
80, 40 and 40 kg/ha of NPK	37073	101	20	201900	164827	4.45
120, 60 and 60 kg/ha of NPK	39110	109	20	217740	178630	4.57
40 and 40 kg/ha of PK	36030	71	20	142500	106470	2.96
80 and 40 kg/ha of NK	35323	80	20	160900	125577	3.56
80 and 40 kg/ha of NP	35793	99	20	197740	161947	4.52
Without NPK (Absolute control)	33000	56	21	116708	83708	2.54

The duration of *kachri* is longer and for increased duration of nutrients supply, right proportion of nutrition is required to meet nutrients supply throughout the crop growth and fruiting period. At this proportion inorganic sources maintained the availability of nutrients at a rate at which crop did not suffer stress..

4. CONCLUSION

The results showed that under hot arid agro-climate where soil is low in organic matter and available plant nutrients are of great importance in increasing yield by the balanced plant nutrients supply. It may concluded that 120, 60 and 60 kg/ha of NPK gave higher yield followed by 80, 40 and 40 kg/ha of NPK 80 and 40 kg/ha of NP which were significantly at par . Besides more yield, this treatment also showed increasing efficiency, net return and B: C ratio.

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